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USATECOM PROJECT NO 8-7-2060-02

USAIB PROJECT NO 3196

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SERVICE TEST OF
PRACTICE HAND GRENADE, XM52
WITH FUZE, XM225

FINAL REPORT

By

2LT GERALD M. HORTON

FEBRUARY 1958

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FEBRUARY 1968

APPROVED:

JAMES I. MUIR, JR.
Colonel, Infantry
President

UNITED STATES ARMY INFANTRY BOARD
Fort Benning, Georgia 31905

ABSTRACT

The Service Test of the Practice Hand Grenade, XM52, with Fuze, XM225, was conducted by the United States Army Infantry Board from 6 November 1967 to 5 January 1968 at Fort Benning, Georgia. The purpose of this test was to determine the physical and technical characteristics as outlined in the Small Development Requirement, and to determine the suitability for US Army use as a training item. One hundred XM52 grenade bodies and two hundred XM225 fuzes were used to conduct this test.

Specific phases of testing under temperate climatic conditions included: physical characteristics, functioning, safety, operational suitability, durability, reliability, maintainability, human factors, and value analysis.

The XM52 grenade and the M30 grenade were comparable as to signature effects (flash, noise level, and smoke discharge). There was a visual difference in the configuration between the XM225 fuze and the M205A2 fuze. The difference in configuration between the XM225 fuze and the M205A2 fuze, and the fact that "IMPACT" was stamped in raised lettering on the safety handle of the XM225 fuze allowed identification at night. The XM52 grenade added the impact functioning to training grenades. There were no shortcomings or deficiencies found in the XM52 grenade.

It was concluded that the Practice Hand Grenade, XM52, with Fuze, XM225, meets the physical and technical characteristics outlined in the SDR; the Practice Hand Grenade, XM52, with Fuze, XM225, is safe and suitable for US Army use as a training item; sufficient quantities of the fuze gaskets and plastic stoppers should accompany the Practice Hand Grenade, XM52, with Fuze, XM225; and the production model grenade bodies should be adapted to both Fuze, M205A2, and Fuze, XM225.

It was recommended that the Practice Hand Grenade, XM52, with Fuze, XM225, be considered suitable for US Army use; sufficient quantities of the fuze gaskets and plastic stoppers accompany the Practice Hand Grenade, XM52, with Fuze, XM225; and production model grenade bodies be adapted to both Fuze, M205A2, and Fuze, XM225.

FOREWORD

The US Army Infantry Board was responsible for preparing
the test plan, test execution, and preparing the test report.

TABLE OF CONTENTS

	<u>PAGE</u>
ABSTRACT-----	iv
FOREWORD-----	v

SECTION 1. INTRODUCTION

1.1 BACKGROUND-----	1
1.2 DESCRIPTION OF MATERIEL-----	1
1.3 TEST OBJECTIVE-----	2
1.4 SUMMARY OF RESULTS-----	2
1.5 CONCLUSIONS-----	3
1.6 RECOMMENDATIONS-----	3

SECTION 2. DETAILS OF TEST

2.1 INTRODUCTION-----	4
2.2 SUBTEST NO 1, PREOPERATIONAL INSPECTION AND PHYSICAL CHARACTERISTICS-----	5
2.3 SUBTEST NO 2, FUNCTIONING-----	8
2.4 SUBTEST NO 3, SAFETY-----	9
2.5 SUBTEST NO 4, OPERATIONAL SUITABILITY-----	11
2.6 SUBTEST NO 5, RE-USABILITY-----	13
2.7 SUBTEST NO 6, DURABILITY AND RELIABILITY-----	14
2.8 SUBTEST NO 7, MAINTAINABILITY-----	16
2.9 SUBTEST NO 8, HUMAN FACTORS-----	16
2.10 SUBTEST NO 9, VALUE ANALYSIS-----	17

SECTION 3. APPENDICES

I. PHOTOGRAPHS-----	18
II. FINDINGS-----	32
III. REFERENCES-----	35
IV. DISTRIBUTION LIST-----	36

SECTION 1. INTRODUCTION

1.1 BACKGROUND

1.1.1 The Fragmentation Hand Grenade, M26A2 (M26A2 grenade), with the Impact-Time Fuze, M217 (M217 fuze), has been in production for some time and is available for troop use. The M217 fuze is an electric, impact-functioning fuze, with an arming delay time of approximately 1 to 2 seconds and an overriding time element which functions within 3 to 7 seconds, depending on temperature and climatic conditions, if no impact function occurs. The soldier using the grenade with the M217 fuze must insure that he avoids overhead obstructions, such as tree limbs, that might cause impact detonation dangerously close to his position. As a result of the inherent danger associated with this fuze, there is a need for a practice grenade and fuze, for training purposes, which safely duplicate the features of the M26A2 grenade with the M217 fuze.

1.1.2 On 16 November 1966 the US Army Infantry School (USAIS) submitted a Draft Small Development Requirement (SDR) for a practice hand grenade with an impact-detonating fuze. Picatinny Arsenal began development of the interim training counterpart of the M26A2 grenade with M217 fuze and prepared draft technical characteristics for the item.

1.1.3 On 17 February 1967 the US Army Test and Evaluation Command (USATECOM) issued a directive to the US Army Infantry Board (USAIB) and the US Army Development and Proof Services (USAD&PS) to conduct service and engineering tests, respectively, of the items identified as the Practice Hand Grenade, XM52 (XM52 grenade), with Fuze, XM225 (XM225 fuze).

1.2 DESCRIPTION OF MATERIEL

The XM52 grenade with the XM225 fuze, hereinafter referred to as the test item, is designed to simulate the appearance, weight, and functioning of the M26A2 grenade with the M217 fuze (fig 3, App I). The test item consists of a modified body of the Practice Hand Grenade, M30 (M30 grenade), a black powder charge, and XM225 fuze, which is a practice version of the M217 fuze. The fuze well threads of the M30 grenade body were changed from 9/16 - 12 UNC to 5/8 - 11 UNC (Unified Coarse Thread Series, 1/4 inch to 4 inches). (The M30 grenade was designed to accept the M205 type fuze which has dimensions different from the M217 and XM225 fuzes.) (Fig 1, and 2, App 1)

1.3 TEST OBJECTIVES

- 1.3.1 To determine the physical and technical characteristics (of the XM52 grenade and XM225 fuze) as outlined in the SDR.
- 1.3.2 To determine suitability for US Army use as a training item.

1.4 SUMMARY OF RESULTS

- 1.4.1 The XM52 grenade conforms to the size, weight, and shape of the M26A2 grenade to the same extent as the M30 grenade.
- 1.4.2 The 95-percent confidence interval about the true reliability was from .98 to 1.00. Based on the results of this test, the point estimate for the reliability was 1.00. Functioning occurred either upon impact or as a result of the time delay element of the fuze.
- 1.4.3 Arming for impact function required an elapsed time of approximately 2 seconds, after the release of the safety lever.
- 1.4.4 It was observed that, when throwing the test item, the soldier must avoid striking overhead obstructions, such as tree limbs, which might cause an impact detonation close to his position.
- 1.4.5 Functioning and physical characteristics of the test item safely simulated the functioning and physical characteristics of the M26A2 grenade with M217 fuze.
- 1.4.6 Signature characteristics (noise and smoke) of the test item were comparable to those of the control item.
- 1.4.7 Safety aspects of the test item were comparable to the control item.
- 1.4.8 No safety hazards were encountered in launching the test item from either the M14 rifle or the M16A1 rifle, nor were there any difficulties encountered.
- 1.4.9 The reusableability of the XM52 and M30 bodies was comparable.
- 1.4.10 Rough handling occurring during transportation, training, or field use did not degrade the reliability of the test item.
- 1.4.11 The test item required no additional maintenance over the control item.
- 1.4.12 The ease of arming and handling of the test item and the control item was comparable.

1.4.13 It was more difficult to remove the expended XM225 fuze from the M52 body than to remove the expended M205A2 fuze from the M30 body.

1.4.14 The test item contained no unnecessary, costly, or nice-to-have features.

1.4.15 Picatinny Arsenal indicated that the production models of the XM52 grenade body would have both ends fitted with threads. By so doing, both the M205A2 fuze and the XM225 fuze could be used with the same grenade body.

1.5. CONCLUSIONS

The United States Army Infantry Board concludes that:

- a. The Practice Hand Grenade, XM52, with Fuze, XM225, meets the physical and technical characteristics outlined in the SDR.
- b. The Practice Hand Grenade, XM52, with Fuze, XM225, is safe and suitable for US Army use as a training item.
- c. Sufficient quantities of the fuze gaskets and plastic stoppers should accompany the Practice Hand Grenade, XM52, with Fuze, XM225.
- d. Production model grenade bodies should be adapted to both Fuze, M205A2, and Fuze, XM225.

1.6 RECOMMENDATIONS

The United States Army Infantry Board recommends that:

- a. The Practice Hand Grenade, XM52, with Fuze, XM225, be considered suitable for US Army use.
- b. Sufficient quantities of the fuze gaskets and plastic stoppers accompany the Practice Hand Grenade, XM52, with Fuze, XM225.
- c. Production model grenade bodies be adapted to both Fuze, M205A2, and Fuze, XM225.

SECTION 2. DETAILS OF TEST

2.1 INTRODUCTION

2.1.1 Test Criteria

The test items were evaluated against the functional and operational characteristics outlined in the SDR.

2.1.2 Test Items

One hundred XM52 grenade bodies and two hundred XM225 fuzes were used to conduct this test.

2.1.3 Control Items

The M30 Practice Hand Grenade, with Fuze M205A2 (M205A2 fuze) was utilized as the control item. It simulated in appearance, weight, and functioning the M26 grenade, with pyrotechnic delay type fuze. Functioning of the M205A2 fuze is designed to occur in 4 to 5 seconds after arming (fig 2, App I).

2.1.4 Test Soldiers

Test soldiers used in this project were representative of those who would normally be expected to operate and maintain the test item in the field. All test soldiers were informed as to the test objectives and the purpose of each subtest in which they participated.

2.1.5 Test Results

Results of all subtests were recorded and analyzed. If appropriate, the qualitative observations and judgments of experienced test personnel concerning the performance of the test items were obtained and were clearly indicated as such and recorded separately from factual data.

2.1.6 Photographic Coverage

Photographic coverage, to include still and motion pictures, were used where appropriate to supplement data obtained during testing.

2.1.7 Safety

Throughout the conduct of this test safety precautions were observed as outlined in:

- a. AR 385-6

b. AR 385-63

c. USATECOM Regulation No 385-7, Safety Confirmation

d. FM 23-30, Grenades & Pyrotechnics, with changes 1-3

2.2 SUBTEST NO 1, PREOPERATIONAL INSPECTION AND PHYSICAL CHARACTERISTICS

2.2.1 Objectives

2.2.1.1 To determine if the test and control items were complete and in proper condition for testing.

2.2.1.2 To determine and compare the physical characteristics of the test and control items.

2.2.1.3 To determine if the test item met the following operational and technical characteristics:

a. "(Essential) The size, weight, and shape of the practice item must be the same as the M26A2 fragmentation hand grenade."

b. "(Essential) The identification features of the practice fuze must be the same as the M26A2 fragmentation grenade."

c. "(Desirable) The fuze should be adaptable to the body of the M-30 practice grenade."

d. "This grenade will add impact detonating capability to the present practice grenades available."

2.2.2 Method

2.2.2.1 The test items were examined and inspected for defects, completeness, and serviceability, using the Preliminary Operating and Maintenance Manual (POMM) and FM 23-30 with changes 1-3 (ref 1 App III).

2.2.2.2 For each of the test and control items were weighed and measured. The average weights and measurements were recorded and compared. Appropriate photographs of the test and control items were taken.

2.2.2.3 Means by which the test item and control item were identified were noted.

2.2.2.4 The fuze of the test item and the M30 grenade were examined to determine if the fuze was adaptable to the body of the grenade.

2.2.2.5 Five each of the test items were detonated by impact functioning and five each by time delay functioning. Five each of the control items were functioned by time delay.

2.2.2.6 Test soldiers were required to identify the test items and control items in the dark.

2.2.3 Results

2.2.3.1 One hundred completely assembled test items were received for testing. One hundred additional XM225 fuzes and plastic bags containing the black powder charge were also received; however, no additional gaskets or plastic stoppers were provided. (Fig 6, App I) The XM225 fuzes without the gaskets could not be securely tightened to the grenade body, because of the uneven mold seams on the face of the fuze well, and loosened easily through normal handling (fig 12, App I). Gaskets were retrieved from expended fuzes for the purpose of expediting test completion. However, it was not feasible to retrieve, or to secure locally, the plastic stoppers which were essential if the test item was to achieve signature characteristics (noise and smoke) comparable to the M30 grenade.

2.2.3.2

Average weights and major dimensions of 10 test items and 10 control items were as follows:

TABLE 1
AVERAGE WEIGHTS AND MAJOR DIMENSIONS

	Weight (oz)	Total Weight (oz)	Length (in)	Diameter(in)
XM52 body	12.5	15.2	3.0	2.3
XM225 fuze	2.7		2.7	.57
M30 body	12.9	15.3	3.0	2.3
M205A2 fuze	2.4		3.7	.25
M26A2 body	13.32	16.0	3.0	2.3
M217 fuze	2.68		2.7	.57

According to the results of this test, there was a difference of .8 ounce between the test item and the M26A2 grenade with the M217 fuze. The test item conforms to the size, weight, and shape of the M26A2 grenade to the same extent as the control item.

2.2.3.3 The XM52 grenade body was painted blue with a brown band and

had the same external appearance as the M30 grenade. The XM225 fuze was painted blue and had the word "IMPACT" embossed on the safety lever (fig 4, App I). The XM225 fuze was of a noticeably different configuration than the M205A2 fuze (fig 4, App I).

2.2.3.4 The M26A2 grenade with M217 fuze is olive drab in color with yellow markings. The M217 fuze has "IMPACT" embossed in raised lettering on the safety lever.

2.2.3.5 Test soldiers could distinguish by touch between the test and control items in the dark.

2.2.3.6 Without modification of the fuze well threads of the M30 grenade body, the XM225 fuze was not immediately adaptable to the grenade. With the modification of the fuze well threads, however, the M30 grenade body was adaptable for use with the XM225 fuze (fig 5, App I).

2.2.3.7 Results of the arming and detonation of test item and control items (para 2.2.2.5) were as follows:

TABLE 2
ARMING AND DETONATION RESULTS

Test Item		Control Item	
Function	Time to Detonation	Function	Time to Detonation
Impact	2.8 seconds		
Impact	2.6 seconds		
Impact	2.0 seconds		
Impact	2.3 seconds		
Impact	2.4 seconds		
Time delay	5.0 seconds	Time delay	4.3 seconds
Time delay	3.2 seconds	Time delay	4.7 seconds
Time delay	6.4 seconds	Time delay	5.1 seconds
Time delay	5.2 seconds	Time delay	5.3 seconds
Time delay	4.1 seconds	Time delay	4.8 seconds

2.2.4 Analysis

2.2.4.1 The lack of gaskets for the unassembled XM225 fuze, together with the rough, uneven surface on the face of the fuze well, which made it impossible to achieve a tight fit of the XM225 fuze to the XM52 grenade body, can be satisfactorily corrected by making the gasket an essential component of the XM225 fuze. When the gaskets were installed, the fuzes could be tightened securely in the fuze well in spite of the rough finish permitted in the fabrication of the XM52 grenade body. (Fig 6, App I) The XM225 gasket was not interchangeable with the M205A2 fuze gasket.

2.2.4.2 The noise created by the detonation of the test item without the plastic stopper is noticeably less than with the plastic stoppers.

2.2.4.3 Sufficient quantities of plastic stoppers and fuze gaskets should accompany the test items (fig 6, App I).

2.2.4.4 Picatinny Arsenal indicated that the production models of the XM52 grenade bodies would be threaded at both ends. One end would be suitable for use with the M205A2 fuzes and the other for use with the XM225 fuzes.

2.3 SUBTEST NO 2, FUNCTIONING

2.3.1 Objectives

2.3.1.1 To determine and compare the effectiveness of the test and control items with respect to fuze functioning.

2.3.1.2 To determine if the test fuze displayed the operational, technical, delay, and impact functioning characteristics of the M217 fuze.

2.3.2 Method

Fuze functioning data from all subtests were collected, recorded, and analyzed in this subtest.

2.3.3 Results

2.3.3.1 All fuzes functioned either upon impact or as a result of the time delay.

2.3.3.2 After arming the test item functioned:

- a. On impact, if sufficient impact was obtained.
- b. On delay, if sufficient impact did not occur.

c. On delay, if no impact occurred (fig 7, App I). (No impact can occur when the XM52 grenade is not thrown after arming, or when it is rifle-launched into a high trajectory.)

2.3.3.3 Arming for impact function was obtained 2 seconds after release of the safety lever. During this test, if impact occurred prior to an elapsed time of 2 seconds after the release of the safety lever, the test item did not detonate upon impact.

2.3.3.4 Increased force of impact prior to the arming of the impact function did not cause detonation of the test item.

2.3.3.5 The time delay function occurred in an elapsed time of 3 to 7 seconds after the release of the safety lever if no impact function was obtained.

2.3.4 Analysis

The 95 percent confidence interval about the true reliability is from .98 to 1.00. Based on the results of this test the point estimate of reliability is 1.00.

2.4 SUBTEST NO 3, SAFETY

2.4.1 Objectives

2.4.1.1 To determine the effectiveness of the safety features of the test item.

2.4.1.2 To determine the adequacy and completeness of the safety instructions contained in the POMM and the safety release.

2.4.1.3 To determine if the test item met the following operational and technical characteristic:

"(Essential) The M217 Fuze, modified to be no more hazardous than the current practice item, shall be utilized in this practice item."

2.4.2. Method

2.4.2.1 All precautions or limitations prescribed in the safety release for the test items were observed during testing.

2.4.2.2 Throughout testing any safety hazards encountered with the test item were noted and recorded.

2.4.2.3 Data collected in all subtests bearing on safety aspects of the test and control items were recorded, analyzed, and compared in this subtest.

2.4.2.4 Safety glasses were worn by the test soldiers since metal fragmentation had been detected during the safety evaluation of the test item, which was conducted at Aberdeen Proving Ground (ref 8, App III).

2.4.3 Results

2.4.3.1 No metal fragmentation of either the test items or control items was detected although the plastic cork was propelled distances up to 15 feet.

2.4.3.2 The employment of the test item by the test soldiers presented hazards in heavily wooded or thickly overgrown areas because of the increased possibility of the armed grenade ricocheting from overhanging tree limbs or nearby tree trunks and rebounding towards the employing personnel. During one trial of Subtest No 4 the armed grenade rebounded to within 5 feet of the test soldier who threw it. The test item did not detonate upon impact with the overhanging tree limb as it did not have sufficient arming time, but it did detonate upon impact with the ground. No injury was sustained.

2.4.3.3 In thick overgrowth and heavily wooded areas the test item detonated 3 times out of 18 trials upon impact with limbs or tree trunks. Impact detonation against limbs or tree trunks occurred only in cases where sufficient arming time had elapsed. When sufficient arming time (2 seconds) for impact function had not elapsed, the test item would detonate upon impact with the ground or would detonate as a result of time delay.

2.4.3.4 It was observed during the night phase of the subtests that burning fragments of the plastic bag containing the black powder charge were projected to distances up to 15 feet by both the test items and control items. (Fig 8, App I)

2.4.4 Analysis

2.4.4.1 The safety of the test item is comparable to that of the control item.

2.4.4.2 POMM 1330-377-10 (PA-DC5) and the safety release were adequate. Although the POMM on page 13 states that "Hand grenade XM52 is not intended for use as a rifle grenade," no safety hazards were detected as a result of rifle launching of the test item from the M16A1 and the M14 rifles as performed in Subtest No 4 (fig 9, 10, and 11, App I).

2.4.4.3 The expelled plastic cord represents an insignificant hazard unless it should strike an individual in the eye at distances less than 15 feet.

2.5 SUBTEST NO 4, OPERATIONAL SUITABILITY

2.5.1 Objectives

2.5.1.1 To determine the suitability of the test item from the training standpoint.

2.5.1.2 To determine if the test item met the following operational characteristic:

"(Essential) The noise and smoke produced by this detonation of the fuze shall be sufficient to enable the average soldier to detect detonation at 40 meters."

2.5.2 Method

2.5.2.1 Six control items and eighteen test items were thrown at a target located in a grove of saplings. Observers were stationed at a minimum distance of 40 meters from the point of detonation (target area). The signature effects (noise and smoke) of the test and control items were noted and compared.

2.5.2.2 Six test items were thrown at a simulated enemy machine gun position located at a higher elevation on the side of a hill. The terrain of the hill was rocky and uneven. Signature effects and results of detonations were recorded.

2.5.2.3 Six test soldiers each dropped one armed test item from shoulder height onto the following surfaces:

- a. Wooden floor
- b. Concrete floor
- c. Foxhole with hard, dry clay bottom

2.5.2.4 Twenty-two test items were armed and thrown into water.

2.5.2.5 Six of the test items were thrown at a target located in a heavily wooded area. Particular note was made of the fuze functioning when the test item struck branches, leaves, and trunks of trees.

2.5.2.6 Six of the test items were thrown against security-type chain link fencing.

2.5.2.7 Ten each of the test items and control items were launched from an M14 rifle onto various surfaces. This exercise was repeated using an M16A1 rifle. To launch the test items and control items from the M14 rifle the Grenade Launching Cartridge, 7.62-mm, M64;

the Grenade Launcher, M76; and the Projection Adapter, M1A2, were used. The M16A1 rifle was equipped with the grenade retaining clip.

2.5.3 Results

2.5.3.1 In a grove of saplings observers stationed at 40, 50, 60, 70, 80, 90, and 100 meters from the impact-detonation target area easily detected the noise of detonation of both the test items and the control items. Where brush, trees, and undergrowth did not obstruct the observers' line of sight, the white puff of smoke discharged by the detonating grenades could be seen. The noise and smoke for the test item and control item were comparable.

2.5.3.2 In open terrain, noise and smoke were detected at all tested ranges to 900 meters and were comparable for both test and control items.

2.5.3.3 All test items, impacting on the ground, rocks, trees, concrete, and all tested solid surfaces, functioned upon impact when the 2-second arming time had been obtained. If the 2-second arming time was not obtained prior to impact, the test items functioned as a result of time delay.

2.5.3.4 The test items detonated upon impact with water if the 2-second arming time was obtained. If the 2-second arming time did not occur, the test items detonated as a result of time delay (3 to 7 seconds).

2.5.3.5 Seven of the 18 test items thrown in a heavily wooded area struck tree limbs and branches which were obstructing the target area. Three of these, the 2-second arming time having elapsed, detonated on impact with the obstructing limbs and branches. Since the 2-second arming time required for impact functioning had not elapsed prior to impact, the remaining four test items did not detonate upon impact with the tree limbs and branches. Sufficient arming time had elapsed, however, when the deflected grenades struck the ground, thereby causing impact functioning. One of the four deflected grenades rebounded to within 5 feet of the test soldier who had thrown it. No injury was sustained.

2.5.3.6 When armed, the test item detonated on impact with chain link fencing.

2.5.3.7 No difficulties were encountered when launching the test items from either the M14 rifle or M16 rifle. It was necessary, however, to utilize a flat trajectory to obtain impact functioning as high trajectories resulted in airbursts in 7 cases out of 20.

TABLE 4
RIFLE LAUNCHING OF TEST ITEM

Weapon	Function	Trajectory
M14	Impact	Flat
M14	Time (airburst)	High
M14	Time (airburst)	High
M14	Impact	Flat
M14	Impact	Flat
M14	Time (airburst)	High
M14	Time (airburst)	High
M14	Impact	Flat
M14	Time (ground)	Flat (skipped on ground)
M14	Impact	Flat
M16	Impact	Flat
M16	Time (ground)	Flat (too short for arming)
M16	Impact	High
M16	Impact	Flat
M16	Time (airburst)	High
M16	Time (airburst)	High
M16	Impact	High
M16	Impact	Flat
M16	Impact	High
M16	Time (airburst)	High

(fig 9, 10 and 11, App I)

2.5.4. Analysis

2.5.4.1 The test item accurately simulates the operational characteristics of the M26A2 grenade with the M217 fuze and is suitable from a training standpoint.

2.5.4.2 The flattest trajectory commensurate with the desired range and weapon launch capability should be used to obtain impact functioning.

2.5.4.3 Leaves had no detectable effect on the impact function of the test item.

2.6 SUBTEST NO 5, RE-USABILITY

2.6.1 Objective

To determine and compare the re-usability characteristics of the test and control items.

2.6.2 Method

2.6.2.1 The bodies of all functioned grenades were inspected for re-use. All grenade bodies were in satisfactory condition for re-use and were reassembled with the extra fuzes and black powder charges available (100 each) and functioned.

2.6.2.2 The functional results of reassembled grenades used in all tests were compiled, analyzed, and compared in this subtest.

2.6.3 Results

2.6.3.1 The re-usability of the test item was comparable to that of the control item.

2.6.3.2 All of the test items and control items which were reassembled functioned satisfactorily.

2.6.3.3 It was more difficult to remove the expended XM225 fuze from the XM52 grenade body than to remove the M205A2 fuze from the M30 grenade body. After being unscrewed, the detonated M205A2 fuze was easily removed from the M30 grenade body. On the other hand, detonation flared the bottom of the XM225 fuze making it necessary to use various degrees of force for removal. This forced extraction did not cause damage or excessive wear on the wall and threading of the fuze well (fig 13, App I).

2.6.4 Analysis

It is the opinion of the USAIB that the re-usability of the XM52 grenade body is not adversely affected as a result of the difficulty in removing expended fuzes.

2.7 SUBTEST NO 6, DURABILITY AND RELIABILITY

2.7.1 Objectives

2.7.1.1 To determine and compare the durability and reliability of the test and control items.

2.7.1.2 To determine if the test item met the following operational and technical characteristics:

a. "(Essential) This grenade shall be sufficiently durable to withstand usage normally encountered in training and transportation."

b. "(Essential) This grenade must be capable of functioning over the same temperature range as the M26A2."

c. "(Essential) This grenade must function reliably in 98% of usage."

2.7.2 Method

2.7.2.1 A firing record of all detonations of the test and control items was maintained.

2.7.2.2 Ten each test and control items were transported unrestrained in the bed of a military vehicle for a distance of approximately 25 miles over varied road and terrain conditions (paved, unpaved, trails, cross-country). Upon completion of this exercise the test and control items were inspected and then detonated. The results were recorded and compared.

2.7.2.3 Ten each of the test items in the unarmed condition were thrown from varying heights onto various surfaces (turf, hard ground, concrete). Following this exercise the test and control items were inspected for damage and then detonated. Any damage and results of detonation were recorded and compared.

2.7.2.4 Throughout all testing data bearing on the durability and reliability of the test and control items were collected, analyzed, and compared.

2.7.2.5 A record was kept of temperature and weather conditions prevailing at the time of testing.

2.7.3 Results

2.7.3.1 The 95-percent confidence interval about the true reliability is from .98 to 1.00. Based on the results of this test, the point estimate of reliability is 1.00.

2.7.3.2 Neither the test items nor the control items sustained damage as a result of being transported 25 miles unrestrained in the bed of a 3/4-ton truck. After the test items and control items were transported, they all functioned satisfactorily.

2.7.3.3 No damage affecting the functioning of the test and control items was sustained as a result of throwing them unarmed from heights varying from 10 to 30 feet onto turf, hard ground, and concrete. All test and control items subsequently functioned properly.

2.7.4 Analysis

Rough handling occurring during transportation, training, or field use does not degrade the reliability of the test item nor do the extremes of temperature (26°F to 75°F) encountered during testing adversely affect the test items' reliability.

2.8 SUBTEST NO 7, MAINTAINABILITY

2.8.1 Objective

To determine if the test item met the following operational and technical characteristic:

"No additional maintenance or performance should be required" over and above that required for the M30 grenade.

2.8.2 Method

2.8.2.1 Maintenance was performed on the test and control items as prescribed in pertinent publications.

2.8.2.2 Maintenance required on the test and control items during the conduct of all subtests was recorded and compared.

2.8.3 Results

2.8.3.1 The test item required no additional maintenance compared to the control item.

2.8.3.2 Since no additional gaskets were included in the materiel received, it was necessary to salvage gaskets from expended test grenades in order to reassemble the XM225 fuzes to the XM52 body satisfactorily after original use.

2.8.3.3 The only maintenance for either the test items and control items was inspection, cleaning, and refuzing.

2.8.4 Analysis

The test item requires no additional maintenance above that normally required by the control item.

2.9 SUBTEST NO 8, HUMAN FACTORS

2.9.1 Objective

To determine and compare the test and control items from a human factors standpoint.

2.9.2 Method

2.9.2.1 Throughout all testing data bearing on human factors aspects of the test and control items were collected.

2.9.2.2 Particular care was made as to ease of arming, handling,

effectiveness of safety features, and compatibility of the test and control items with the skills and limitations of representative soldiers.

2.9.3 Results

2.9.3.1 There was no difference in ease of arming and handling between the test items and control items.

2.9.3.2 Test soldiers, tended to throw the grenade in a flat trajectory, consequently the impact function of the test item did not have sufficient time to arm. After additional instruction on the arming characteristics of the test item, the test soldiers were careful to provide sufficient trajectory (minimum of 16 feet) to their throws to obtain impact functioning of the test item.

2.9.4 Analysis

2.9.4.1 Special emphasis has to be placed on the arming characteristics of the impact function of the test item for the test soldiers to appreciate the necessity of obtaining a sufficiently high trajectory to their throws.

2.9.4.2 Training procedures and instructional content should emphasize the time factor and height of trajectory required of the test item if optimum reliability and effectiveness is to be obtained for the impact function.

2.10 SUBTEST NO 9, VALUE ANALYSIS

2.10.1 Objective

To determine if the test item had any unnecessary, costly, or nice-to-have features which could be eliminated without adversely affecting its performance, reliability and/or safety.

2.10.2 Method

During the conduct of all subtests any nonessential or nice-to-have features which could be modified or deleted without compromising the effectiveness or safety of the test item were noted.

2.10.3 Results

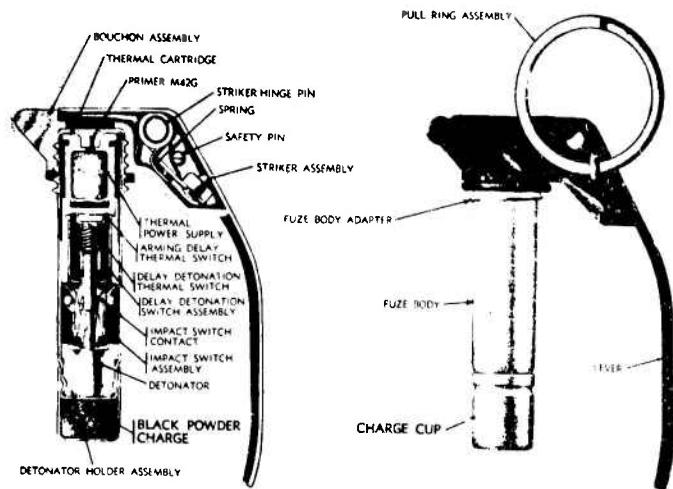
The test item had no unnecessary, costly, or nice-to-have features.

2.10.4 Analysis

Not applicable.

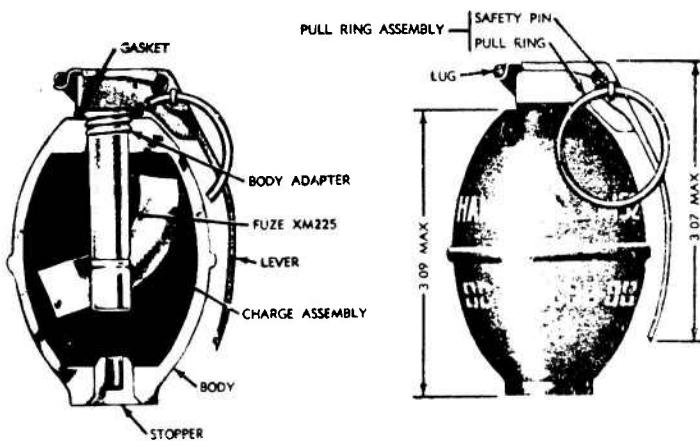
SECTION 3. APPENDICES

APPENDIX I. PHOTOGRAPHS



ORD D1764

Practice Hand Grenade Fuze XM225



ORD D1763

Practice Hand Grenade XM225

Figure 1

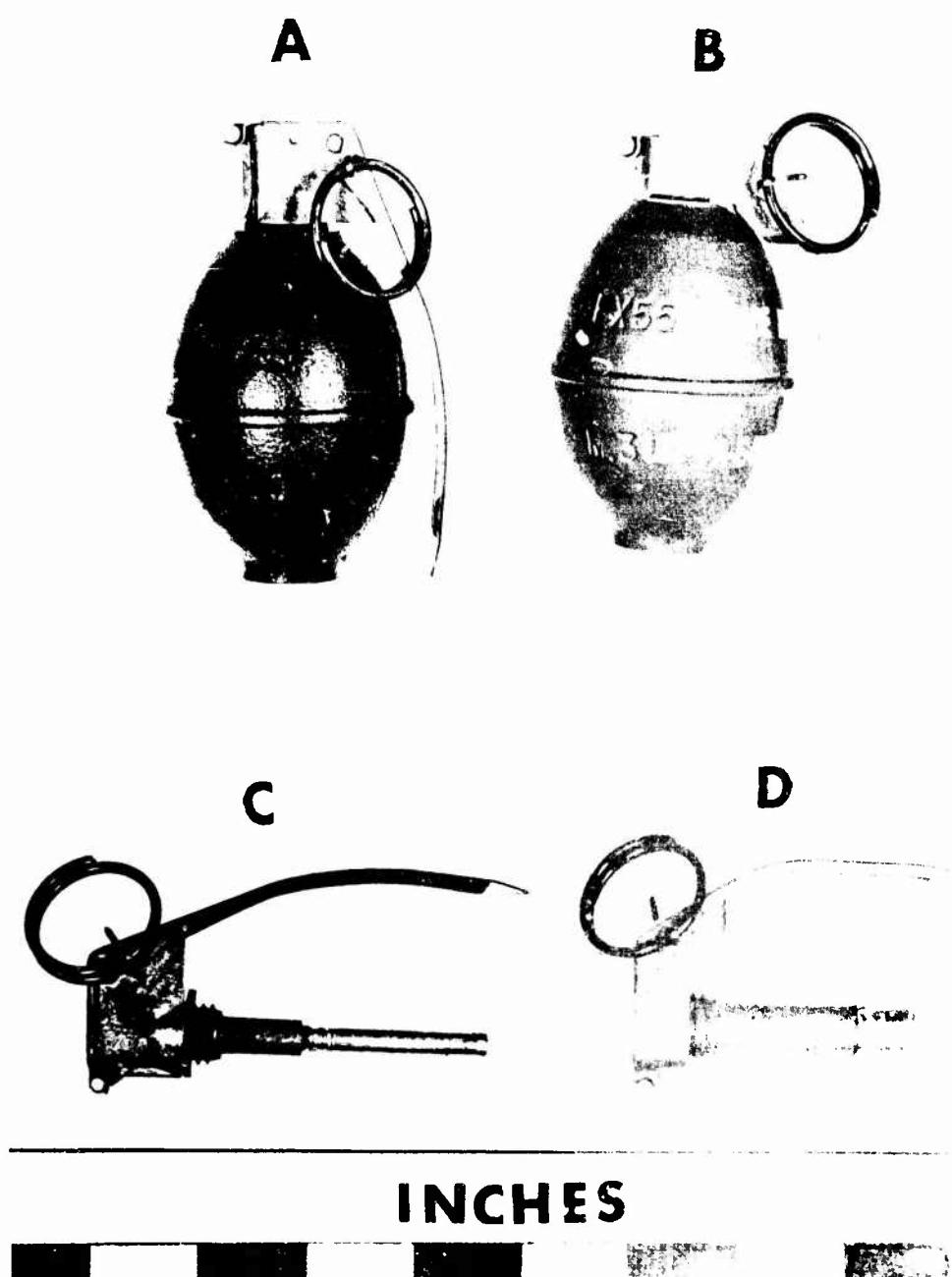
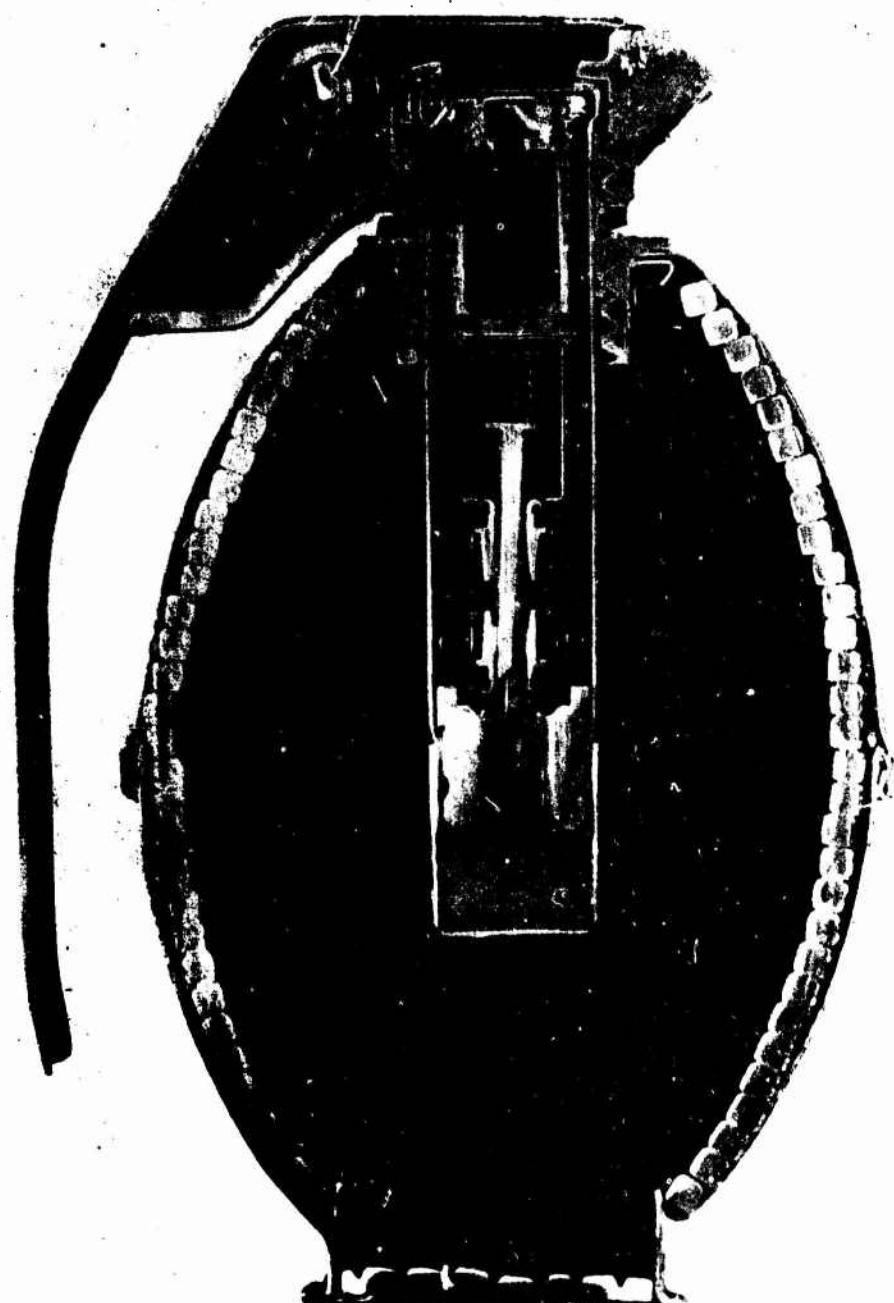


Figure 2

- A. The Practice Hand Grenade, M30, with Fuze, M205A2
- B. The Practice Hand Grenade, XM52, with Fuze, XM225
- C. The Practice Fuze, M205A2
- D. The Practice Fuze, XM225



Figure

Cutaway view of the Fragmentation Hand
Grenade M26A2, with Fuze, M217



A



B

INCHES

Figure 4

- A. The safety lever of the XM225 fuze with the embossed lettering, "IMPACT." The raised lettering facilitates identification at night.
- B. The expended XM225 fuze.

A



B



INCHES



Below the word 'INCHES' are six horizontal scale markings of increasing length from left to right, used for measurement reference.

Figure 5

- A. Practice Hand Grenade Body, M30
- B. Practice Hand Grenade Body, XM52

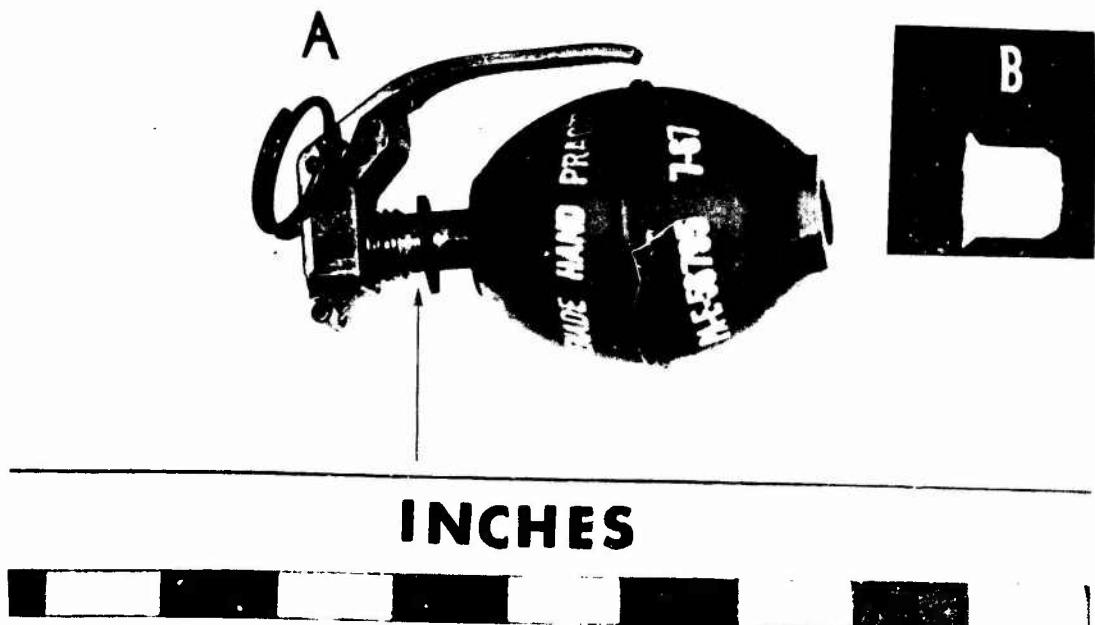


Figure 6

- A. The Practice Hand Grenade, XM52, with Fuze, XM225. The arrow indicates positioning of the rubber gasket on the XM225 fuze. The rubber gasket is necessary to seat the fuze into the XM52 grenade body securely.
- B. The plastic stopper which fits into the end of the grenade body.

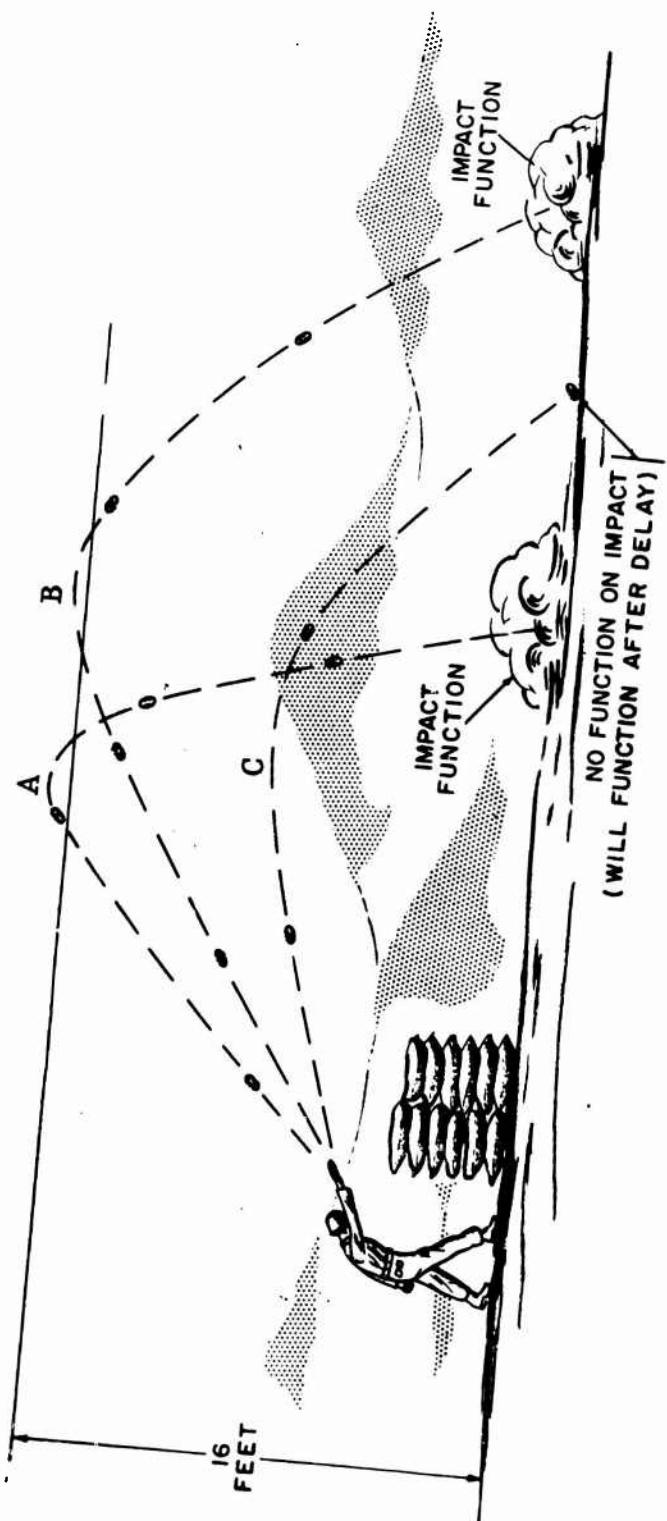


Figure 7

ORD D1765

Impact Functioning Use of Practice Hand Grenade XM52 W/Fuze XM225

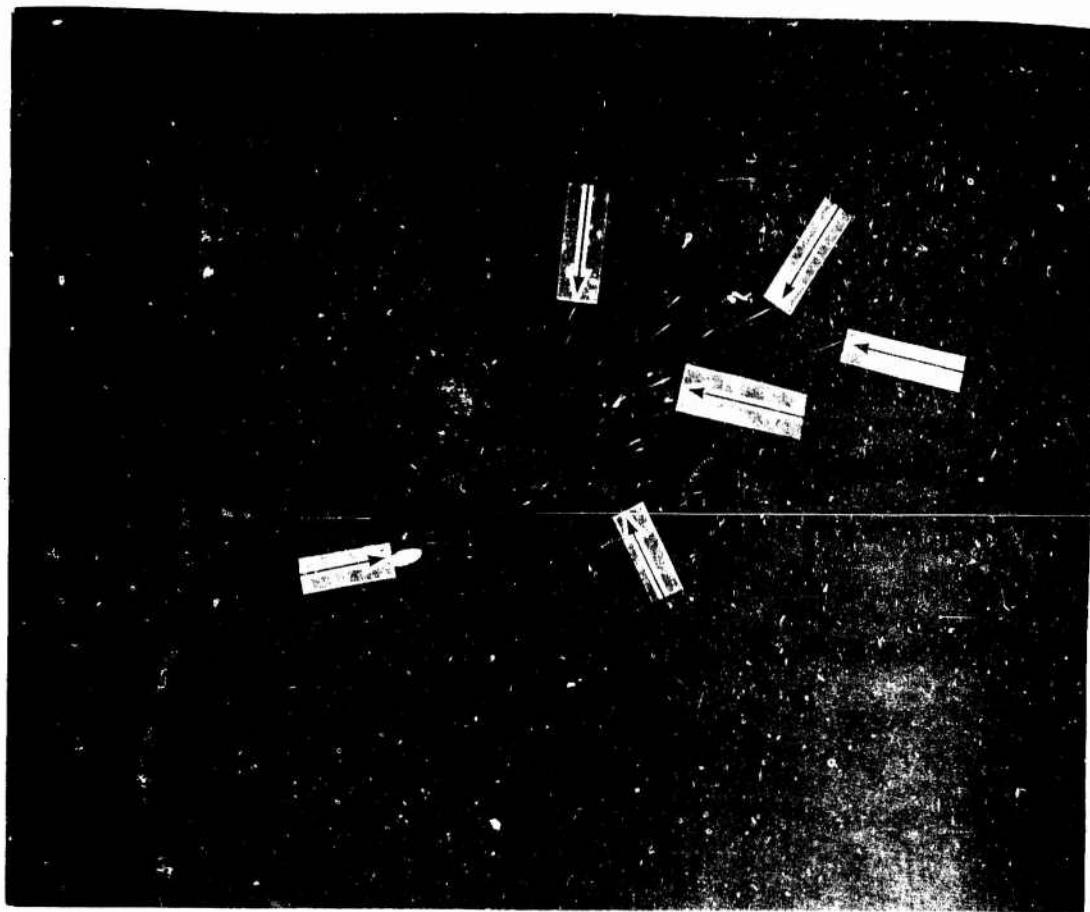


Figure 8

The Practice Hand Grenade, XM52, with Fuze, XM225, detonating at night. The burning particles being ejected are bits of the plastic powder bag.

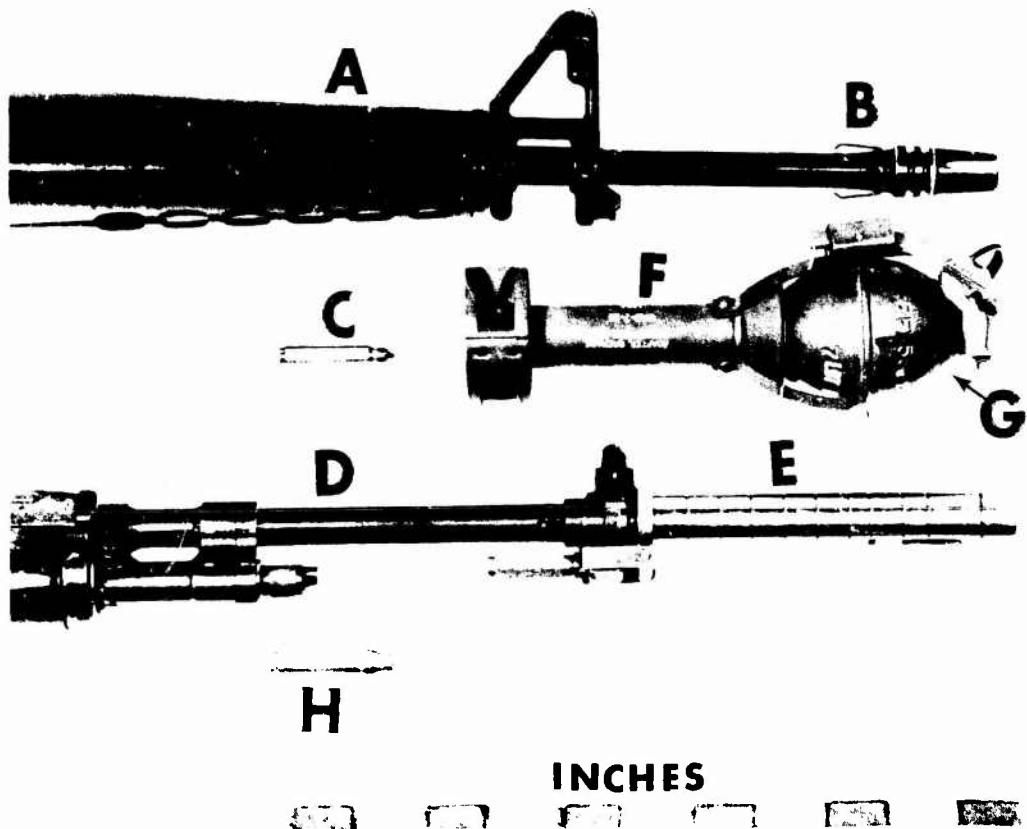


Figure 9

- A. Rifle, 5.56-mm, M16A1
- B. Clip, Retaining, Grenade Launcher
- C. Cartridge, Grenade Launching, XM195
- D. Rifle, 7.62-mm, M14
- E. Grenade Launcher, M76
- F. Adapter, Grenade Projection, M12A2
- G. Practice Hand Grenade, XM52, with Fuze, XM225
- H. Cartridge, Grenade Launching, M64



Figure 10

Test soldier launching Practice Hand
Grenade, XM52, with Fuze, XM225, from
the M16A1 rifle.



Figure 11

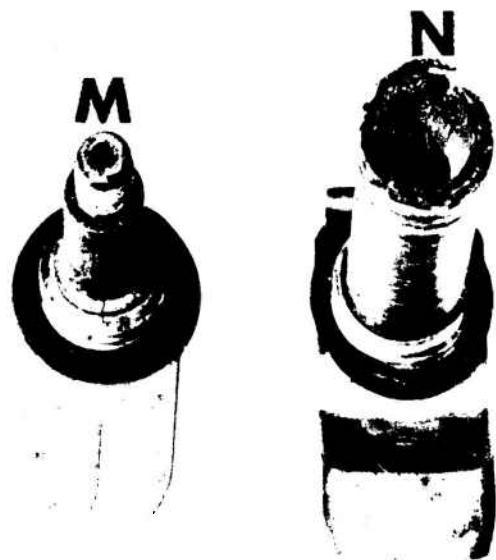
Test soldier launching Practice Hand
Grenade, XM52, with Fuze, XM225, from
M14 rifle.



INCHES

Figure 12

Practice Hand Grenade Body, XM52.
Arrows indicate rough, uneven mold
seams.



INCHES



Figure 13

M. The expended Practice Fuze, M205A2.

N. The expended Practice Fuze, XM225.

APPENDIX II. FINDINGS

PART 1

The basis for the evaluation in this test was the characteristics extracted from the Draft Proposed Small Development Requirement (SDR) for Practice Hand Grenade with Impact Detonating Fuze prepared by the United States Army Infantry School, 16 November 1966 (ref 3, App III).

<u>Requirement</u>	<u>Findings</u>
--------------------	-----------------

* * * * *

2. Purpose and Operational Characteristics

* * * * *

b. Operational characteristics

(1) Configuration

a. (Essential) The size, weight, and shape of the practice item must be the same as the M26A2 fragmentation hand grenade.

Requirement met.
(Subtest No 1)

b. (Essential) The identification features of the practice fuze must be the same as the M26A2 fragmentation grenade.

Requirement met.
(Subtest No 1)

c. (Desirable) The fuze should be adaptable to the body of the M-30 practice grenade.

Requirement partially met. The fuze well threads of the M-30 practice grenade must be modified for use with the XM225 fuze. (Subtest No 1)

* * * * *

(2) Performance

a. (Essential) [Have] The delay and impact functioning characteristics of the *** impact detonating fuze, M-217.

Requirement met.
(Subtest No 2)

b. (Essential) The noise and smoke produced by the detonation of the fuze must be sufficient to enable the average soldier to detect detonation at 40 meters.

Requirement met.
(Subtest No 4)

App II

Requirement

Findings

(3) Reliability and Durability

a. (Essential) This grenade shall be sufficiently durable to withstand the abuse normally encountered in training usage, transportation, and prolonged storage, in accordance with para 7.1, change 1, AR 705-15.

Requirement met (limited to prevailing temperature conditions). (Subtest No 6)

b. (Essential) This grenade must be capable of functioning over the same temperature range as the M-26A2.

Requirement met (limited to prevailing temperature conditions). (Subtest No 6)

c. (Essential) This grenade must function reliably in 98% of usage.

Requirement met (limited to prevailing temperature conditions). (Subtest No 6)

* * * * *

f. Comparison with existing equipment and indication of standard items to be replaced, if any.

Requirement met. (Subtest No 1)

(1) This grenade will add impact deconating capability to the present practice grenades available.

* * * * *

g. Consideration of human factors, including qualitative and quantitative personnel requirements.

Requirement met. (Subtest No 8)

(1) No additional personnel will be required to employ this grenade.

h. Consideration of probably maintenance effort.

Requirement met. (Subtest No 7)

(1) No additional maintenance training or performance should be required.

* * * * *

5. Maintenance Concept

a. No maintenance over and above that required for the M30 practice grenade should be required.

Requirement met. (Subtest No 7)

* * * * *

PART 2

Extracted from technical characteristics prepared by Picatinny Arsenal for Interim Practice Grenade with Impact Detonating Fuze, 1 March 1967 (ref 7, App III).

Requirement

Findings

"* * * * *

2. Purpose and Operational Characteristics

* * * * *

b. Operational Characteristics.

(1) Configuration

* * * * *

(b) (Essential) The M217 Fuze, modified to be no more hazardous than the current practice item, shall be utilized in this practice item.

Requirement met.
(Subtest No 3)

* * * * *

APPENDIX III. REFERENCES

1. FM 23-30, Grenades and Pyrotechnics, with Changes 1-3, 28 October 1959
2. TM 9-1330-200, Hand Grenades and Rifles, June 1966.
3. Draft Proposed Small Development Requirement (SDR) for Practice Hand Grenade with Impact Detonating Fuze, 16 November 1966, prepared by the US Army Infantry School.
4. Letter, SMUPA-DR7, Picatinny Arsenal, 14 December 1966, subject: "M26A2 Grenade with Impact Fuze."
5. Letter, AMSTE-BC, USATECOM, 10 February 1967, subject: "Program Data Sheets for Engineering and Service Test of Grenade, Hand, Practice, XM52, with Fuze, Practice, XM225."
6. Letter, AMSTE-BC 8-7-2060-01/02, USATECOM, 17 February 1967, subject: "Test Directive for Engineering and Service Test of Practice Hand Grenade, XM52, with Fuze, XM225."
7. Technical Characteristics for Interim Practice Hand Grenade with Impact Detonating Fuze, 1 March 1967, prepared by Picatinny Arsenal.
8. Letter, STEAP-DS-TI, Aberdeen Proving Ground, 7 July 1967, subject: "Safety Evaluation of Practice Hand Grenade, XM52 with Fuze, XM225, USATECOM Project No. 8-7-2060-01."

APPENDIX IV. DISTRIBUTION LIST

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1. ORIGINATING ACTIVITY (Corporate author) US Army Infantry Board Fort Benning, Georgia 31905		2a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED
2b. GROUP		
3. REPORT TITLE SERVICE TEST OF PRACTICE HAND GRENADE, XM52, WITH FUZE, XM225		
4. DESCRIPTIVE NOTES (Type of report and inclusive dates) Service Test - 6 November 1967 to 5 January 1968		
5. AUTHOR(S) (Last name, first name, initial) GERALD M. HORTON, 2LT, QM		
6. REPORT DATE February 1968	7a. TOTAL NO. OF PAGES 42	7b. NO. OF REFS 8
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c. d.		
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11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY Commanding General, US Army Munitions Command, Dover, New Jersey	
13. ABSTRACT The Service Test of the Practice Hand Grenade, XM52, with Fuze, XM225, was conducted by the US Army Infantry Board from 6 Nov 67 to 5 Jan 68 at Fort Benning, Georgia. The purpose of this test was to determine the physical and technical characteristics as outlined in the SDR and to determine the suitability for US Army use as a training item. One hundred XM52 grenade bodies and 200 XM225 fuzes were used to conduct this test. Specific phases of testing under temperate climatic conditions included: physical characteristics, functioning, safety, operational suitability, durability, reliability, maintainability, human factors, and value analysis. The XM52 grenade and the M30 grenade were comparable as to signature effects (flash, noise level, and smoke discharge). There was a visual difference in the configuration between the XM225 fuze and the M205A2 fuze. This difference, and the fact that "IMPACT" was embossed in raised lettering on the safety handle of the XM225 fuze, allowed identification at night. The XM52 grenade added the impact functioning to training grenades. There were no shortcomings or deficiencies found in the XM52 grenade. It was concluded that the XM52 grenade with XM225 fuze meets the physical and technical characteristics outlined in the SDR; the XM52 grenade with XM225 fuze is safe and suitable for US Army use as a training item; sufficient quantities of fuze gaskets and plastic stoppers should accompany the XM52 grenade and XM225 fuze; and the production model grenade bodies be adapted to both M205A2 fuze and XM225 fuze. It was recommended that the XM52 grenade with XM225 fuze be considered suitable for US Army use; sufficient quantities of fuze gaskets and plastic stoppers accompany the grenade and fuze; and production model grenade bodies be adapted to both M205A2 and XM225 fuzes.		

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14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Training impact grenade. Impact fuze functioning. Practice hand grenade. Time delay.						
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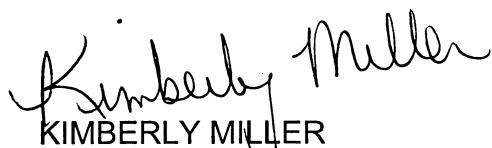
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15 Jun 12

MEMORANDUM FOR Headquarters, Defense Technical Information Center,
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SUBJECT: Freedom of Information Act (FOIA) Request Review
DTIC File #: 2012-17 – Mr. Tom Tangen

1. The following reports were forwarded to this office for review and processing:
 - Feb 68, Service Test of Practice Hand Grenade, XM52 with Fuze, XM225, AD0828910; and
 - 2 Jun 65, Service Test of Smokeless, Flashless, XM463, 40-MM Cartridge, AD0368075
2. Our subject matter experts have determined that the reports are releasable to the public and have been provided to Mr. Tangen in their entirety.
3. I can be reached at (973) 724-6589, or via electronic mail at Kimberly.a.miller3@us.army.mil should you have any questions.


KIMBERLY MILLER
Freedom of Information
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